THE DEVELOPMENT OF EXPERIMENTAL GUIDANCE BOOK OF INORGANIC CHEMISTRY WITH MATERIAL SAFETY DATA SHEET

Rusly Hidayah, Bambang Sugiarto, Dina Kartika Maharani
Chemistry Department FMIPA Universitas Negeri Surabaya
Jl. Ketintang Surabaya (60231), Telp. 031-8298761

Email: ruslyhidayah@unesa.ac.id

Abstract: *The purpose of this research is to develop experimental guidance book for inorganic chemistry with material safety data sheet. Design of development experimental guidance book was R & D by Plomp (2010). Data of the research was analyzed by descriptive statistic. The result of the research were: (1) the experimental guidance book in developing are good in content validity, language validity, presentation validity, and graphic validity; (2) the experimental guidancw book in developing are practice based on students response and students activity; (3) the experimental guidance book in developing are efective based on learning outcome.*
Keywords: development, experimental guidance book, Material Safety Data Sheet.

INTRODUCTION

Practicum of Inorganic Chemistry is aims to students having competence in recognizing the periodic nature of the elements and recognize the characteristics of inorganic species, especially in the form of compounds. Practicum is a learning strategy or form of teaching that used for psychomotor skills (skills), understanding (knowledge), and affective (attitude) using laboratory facilities [1]. Laboratory as a place of doing experiment which demands high sincerity. According to Moran [2], although depending on the guidance of lecturers, students actually doing practicum activities. They must work with the chemicals that use secure and safety. Everyone who works in the laboratory responsible for complying with safety and security in order to protect themselves and others.

Most work accidents are caused by unsafe behavior, the rest are unsafe conditions. According to research by the *National Safety Council* [3], causes of occupational accidents due to *unsafe behavior* (88%), *unsafe condition* (10%), and unknown cause (2%). Therefore, all that will do the lab work, the practitioner, must use protective equipment, understand the handling of chemicals, or the tools that used. To know the handling of chemicals are used, the practitioner must have read the Material Safety Data Sheet (MSDS).

Experimental guidance book is one of the media that contains the implementation of practical activities that contain lab procedures so as to assist in the smooth process of the practicum. Experimental guidance book that using now, yet equipped with MSDS. In fact, it is so important for the practitioner as an effort to find out the handling and caution in the use of chemicals in lab activities. Therefore, it is necessary to prepare a experimental guidance book with MSDS.

METHODOLOGY

This type of research is the research development with development model that adapted from Plomp [4] which consists of three phases: preliminary, prototype, and assessment. The experiment was conducted on 20 students of chemistry departemen with one group pretest-posttest

design method. Required data obtained from the method of review sheet, validation sheet, student response questionnaire, student activity observation sheet, and test of learning result.

Data obtained from the review result of chemistry lecturer, processed by descriptive qualitative improvement suggestions and considerations to the draft of experimental guidance book that development. The validation data obtained from the chemistry lecturer on the developed experimental guidance book is analyzed quantitatively. This analysis is performed on every aspect (point) on each criterion relating to content, language, and graphics components.

The result of questionnaire of student response to the developed experimental guidance book was analyzed by presenting the result of student's answer with formula:

$$P = \frac{F}{N} x\ 100\%$$

Information:
P = Presentation of respondents answer
F = number of respondents who answered
N = number of respondents

Observation result of students activities analyzed descriptive quantitative, ie description of observation result is use to provides an overview of the activities which doing in practicum during the limited trial. students activities are observed and recorded by observers on observation sheets of students activities during the activity. Student learning outcomes have done to determine the mastery of student concepts with experimental guidance book which developed about work safety in the laboratory. The pretest and posttest that used are multiple choice (objective). Achievement of competence is assessed using a scale of 0-100 and then converted into predicates A through E.

RESULTS AND DISCUSSION

The design of research that used is adapting the development model of Plomp [4] which consists of three phases: preliminary research phase, prototype making phase, and assessment phase. These three phases can be described as follows:

1. Preliminary research phase

Preliminary research phase is doing to determine the basic problem which required to develop experimental guidance book. In this step is doing initial investigation by looking at their college of practicum in inorganic chemistry that must have experimental guidance book which support the learning process.

2. Prototype making phase

In this step, designs intended to produce prototypes. The prototype design is aexperimenta guidance bookwhich completed with MSDS. In addition, instrument designs also include validity instruments, practicality, and effectiveness.

a. Prototype design

The prototype design is an experimental guidance book of inorganic chemistry with MSDS, some reference standard labeling of chemicals and how to use a fire extinguisher.

b. Instrument design

1). Validity instrument

Instrument of validity in the form of validation sheets that designed to know the feedback of the validator. Before validation, the experimental guidance book is reviewed by the reviewers.

2). Practicality intrument

Practicality instrument in the form of response sheets from students. This response sheets is designed to know the feedback of users, there is students which is reviewed from several aspects. The response of students also supported by student activity observation sheets during using

experimental guidance book. The activity of unersity students which observed is activity for every students which observed by observer.

3). Effectiveness istrument

Effectiveness instrument in the form of writing test which consists of *pretest* and *posttest*. The preparation of written tests in this research focused on labor safety in the laboratory.

3. Assesment phase

In this phase doing two activities, there are validation of experimental guidance book and limited trial.

a. Complete Review and Validation

The cycle

The prototype 1 generated during the prototype-making phase was reviewed by 2 Chemistry lecturers of FMIPA Unesa to obtain suggestions or feedback on the develop of experimental guidance book. This aims to avoid errors that have a bad impact during the validation stage and for the perfection of the experimental guidance book. Some of the reviewers' or suggestions about the experimental guidance book are enlarge the title of the book and the MSDS is placed after the experimental guidance. After the results of review, then made a revision, so resulting in prototype 2. After that, the second prototype is validated. Validation aims to determine the feasibility of experimental guidance book. Validation was assessed by 2 Chemistry lecturers FMIPA Unesa. Validator fills validation sheet. Assessment is done by choosing one of the five assessment levels. Data from the result of validator assessment will be analyzed descriptively quantitative to know the feasibility of experimental guidance book. If after processed, the results show invalid it will be a major revision and after that, re-validation of the validation results until the experimental guidance book which developed got valid categories. Based on the results of the assessment by the validator, then obtained the validity based on the content criteria with a percentage of 95% and can be interpreted that experimental guidance book based on content criteria get very good criteria. Validity based on linguistic criteria gets a percentage of 86% indicating that the experimental guidance book gets very good criteria. Validity based on the presentation criteria gets a percentage of 94% indicating that the experimental guidance book receives very good criteria. Validity based on the graph criteria also gets very good criteria with a percentage of 96%. Based on the four criteria of validity, it can be concluded that the appropriate experimental guidance book is used for continuation at a limited trial stage.

b. Limited Trial

The purpose of the trial is to determine the feasibility of the experimental guidance book. The trial was conducted on a limited scale of 20 students of the KB in 2013 family class with *one-pretest-posttest design* method.

Students are given a matter of pretest done within 45 minutes. After that, students are given an explanation of the title of the practicum that will be done. A total of 6 practicum titles were conducted by students in groups. Filling MSDS in the book practicum carried out before the students doing lab work in the laboratory. During student practice, observers observe student activities in groups. At the last meeting, then the students are given a matter of post test is done within 45 minutes. Furthermore, students fill out a response questionnaire.

The results of the limited trial were analyzed descriptive quantitative to determine the feasibility of the experimental guidance book. The following results are presented from a limited trial:

1) Result of questionnaire of student response

Questionnaire of student response was given to 20 students who have used experimental guidance book that aim to know students' opinions about experimental guidance book.

Questionnaire responses of students who on average give positive responses from 10 questions given.

2) Observation Result of Student Activity

During the students do practicum by using experimental guidance book, then observation of student activity by observer by using observation sheet of student activity. all student activity during practicum by using experimental guidance book is in good predicate as many as 6 students and 14 students get very good criteria.

Based on student response and supported by student activity, it can be concluded that the experimental guidance book meets the criteria of practicality.

3) Tests of Learning Outcomes

These learning outcomes are presented on pretest and post test. Pretest is given to students before using the experimental guidance book and post test is given after the students use the experimental guidance book. Pretest and post test was given to 20 chemistry students of class KB of 2013 in State of Surabaya. In the pre test the highest score is 65 with the predicate enough (C) and the lowest value is 40 with less predicate (D), so no student is complete during pre test. For the post test the highest score is 100 with very good predicate (A) and the lowest score 75 with good predicate (B), so that all students are complete.

Based on student learning result, it can be concluded that the experimental guidance book meets the effective criteria.

CONCLUSION

Based on data analysis and discussion, it can be concluded that:

1. The validity of experimental guidance book of inorganic chemistry with Material Safety Data Sheet is indicated by validity based on the criteria of content with a percentage of 95%, the validity based on the language criterion obtains a percentage of 86%, the validity based on the presentation criteria gets a percentage of 94%, the validity based on the graph criteria with percentage of 96%.
2. The practicality of experimental guidance book of inorganic chemistry with Material Safety Data Sheet is shown by questionnaire of student response which give positive response average and observation result of student activity which average get very good criteria.
3. The effectiveness of experimental guidance of inorganic chemistry accompanied by Material Safety Data Sheet is indicated by the result of student learning which get 100% completeness at post test.

ACKNOWLEDGMENTS

Acknowledgments are sent to the Department of Chemistry, Faculty of Mathematics and Natural Sciences, State of Surabaya for the support of this research fund through Policy Research Faculty / Department of budget year 2016.

REFERENCES

1. Zainuddin, M. 2001. *Praktikum*. Jakarta: Universitas Terbuka.
2. Moran, Lisa dan Tina Masciangoli. 2010. *Keselamatan dan Keamanan Laboratorium Kimia: Panduan Pengelolaan Kimia dengan Bijak*. Washington DC: The National Academies Press.
3. National Safety Council. 2011. *Annual Report: Highlighting The Successes Of The Past Year In Preventing Injuries And Saving Lives.* Washington DC: NSC
4. Plomp, Tjeerd. "*Educational Design Research:* An Introduction" Dalam Tjeerd Plomp dan Nienke Nieeven (Ed.). 2010. *An Introduction to Educational Design Research. Enschede*: SLO. Netherland Institute for Curriculum Development.